

## Further analysis II

### Objective

- To study the effect of the initial condition on the output of the LV equations.

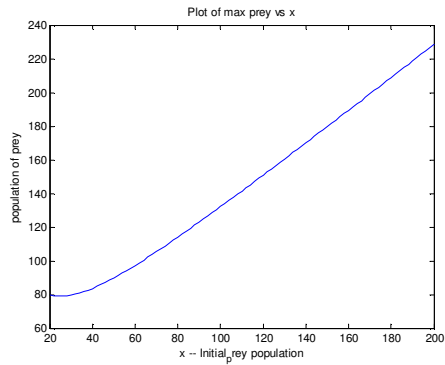
$$dX/dt = aX - bXY \text{ -----(1)}$$

$$dY/dt = cXY - dY \text{ -----(2)}$$

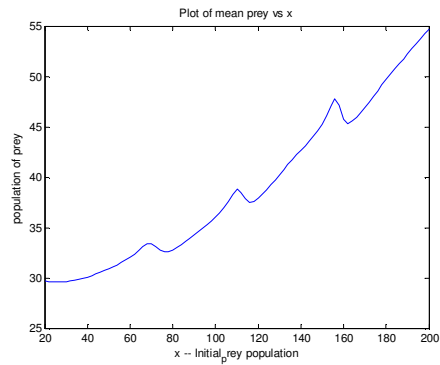
### Methods

- By setting the initial condition to  $a = 1$   $b = 0.1$   $c = 0.02$   $d = 0.5$   $X(0) = 20$   $Y(0) = 3$
- Increasing  $X(0)$  from 20 to 200 &  $Y(0)$  from 3 to 30 respectively
- Plot the max, mean value and period of the output prey and predator against changing parameter
- See appendix for full-sizes graphs

### Analysis of $X(0)$ – the initial population of prey

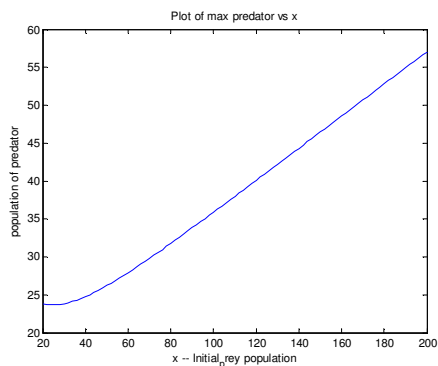


Graph of Max prey against  $X(0)$

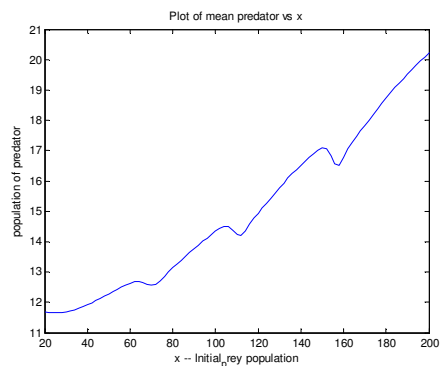


Graph of Mean prey against  $X(0)$

- The overall population is increased with increasing initial population of prey

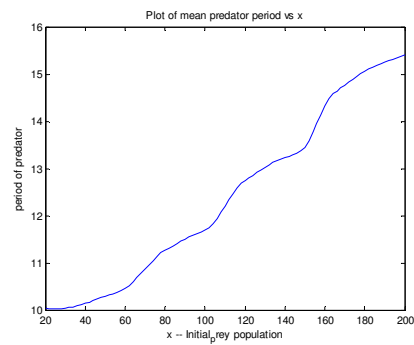
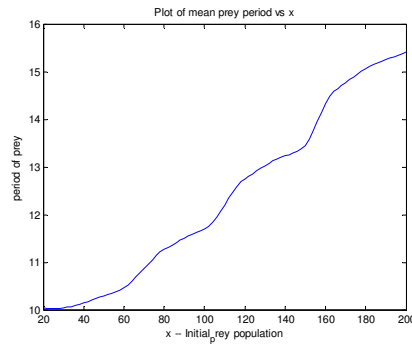


Graph of Max predator against  $X(0)$



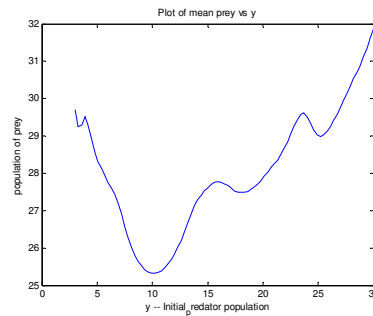
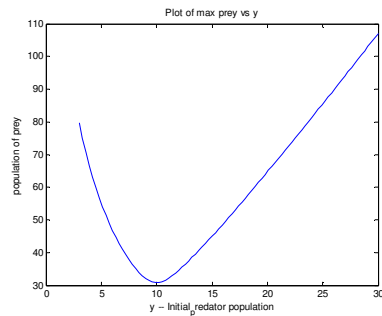
Graph of Mean predator against  $X(0)$

- It is observed that the behaviour of prey and predator is the same



- The period of the oscillation is increased by 55%

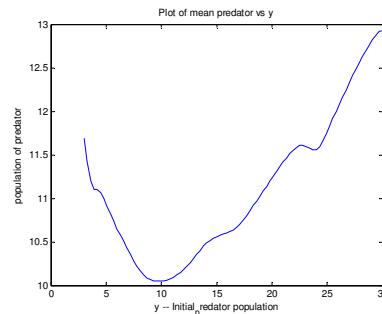
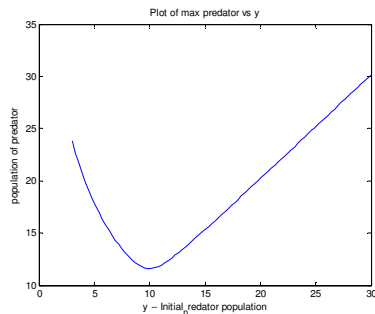
**Analysis of  $Y(0)$  – the initial population of predator**



Graph of Max prey against  $Y(0)$

Graph of Mean prey against  $Y(0)$

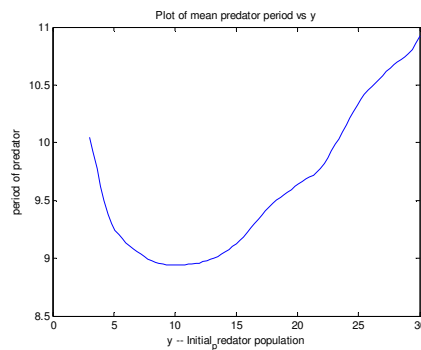
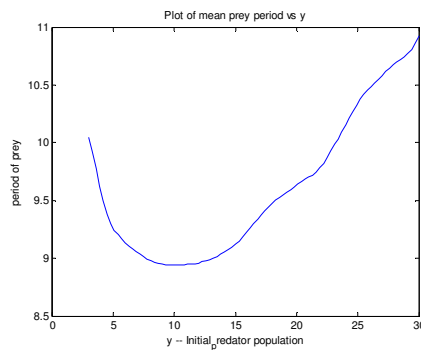
- A curve is observed with increasing predator population, minimum occurs at  $Y(0)=10$



Graph of Max predator against  $Y(0)$

Graph of Mean predator against  $Y(0)$

- It is observed that the behaviour of prey and predator is the same



- The change of period is about 10% from 10 units

### **Conclusion**

- It is interesting that the population behaviours of prey and predator is the same when respond to change of initial population of prey or predator. This is probably due to the fact of the closed contour of Predator against Prey graphs.
- Changing of the initial conditions will result in the change of the overall population of prey and predator and their oscillation period. Hence there are six parameters in LV equations that can alter the output behaviours.

## Appendix

